Indonesian Journal of Electrical Engineering and Computer Science
Vol. 27, No. 1, July 2022, pp. 386~394
ISSN: 2502-4752, DOI: 10.11591/ijeecs.v27.i1.pp386-394

Internet of things based mobile application to improve citizen security

Yulihño Ochante-Huamaccto[1], Francis Robles-Delgado[1], Fernando Sierra-Liñan[2], Cabanillas Carbonell-Michael[3]
[1]Facultad de Ingeniería y Arquitectura, Universidad Autónoma del Perú, Lima, Perú
[2]Facultad de Ingeniería, Universidad Privada del Norte, Lima, Perú
[3]Vicerrectorado de Investigación, Universidad Norbert Wiener, Lima, Perú

Article Info

Article history:

Received Jan 24, 2022
Revised Apr 21, 2022
Accepted May 19, 2022

Keywords:

Citizen security
Crime
Internet of things
Mobile application
Scrum

ABSTRACT

Citizen insecurity is a social problem that has increased considerably around the world. To combat it, in this research a mobile application based on internet of things (IoT) has been developed with the objective of mapping crimes and incident alerts to improve citizen security. Scrum methodology was used and a significant improvement can be seen with respect to the following indicators: number of reports of dangerous places, with an increase of 102.7%; the second indicator: number of reports by type of crime, with an increase of 25.34%; and the indicator: response time to attention, with an increase of 23.5%. It is determined that there is a significant positive influence of the mobile application developed to improve citizen security.

This is an open access article under the CC BY-SA license.

Corresponding Author:

Cabanillas Carbonell-Michael
Vicerrectorado de Investigación, Universidad Norbert Wiener
Av. Arequipa 440 con Jr. Larrabure y Unanue 110. Urb. Santa Beatriz, Lima, Perú
Email: mcabanillas@ieee.org

1. INTRODUCTION

According to the United Nations Office on Drugs and Crime (UNODC) [1], crime is a global problem, some 464 million people worldwide have been victims of crime and murder in recent years. Likewise, the UNODC [2] mentions that crime is a social problem that undermines public safety, in addition to violating the good customs recognized by citizens. Perceptions of insecurity are almost universal, with 82.3% of Peruvians believing they could be victims of crime in the next 12 months.

Particularly in Peru, 18.6% of Peruvians over 15 years of age have been victims of crime, according to the technical report on Citizen Security of the Instituto Nacional de Estadística e Informática (INEI), corresponding to the semester November 2020 to April 2021 [3]. Currently, large amounts of data are generated by interconnected devices through the internet of things (IoT) [4], [5], taking into account that the use of applications allows the dissemination and management of this data [6]. Given the global health emergency Covid-19, we spend 38.3% more time with our cell phone in our hand [7], which is why it is very important to combat the social problem of crime through mobile applications. Citizen security [8] is the action integrated by the state in collaboration with the citizens, with the objective of ensuring a peaceful life, cooperating with the eradication of violence, with the peaceful coexistence of the streets and public spaces as well as contributing to the prevention of crimes.

Many times, dangerous places do not coincide exactly with those reported at police stations, and thanks to technological advances, mobile applications play a very important role [9]. A dangerous place

according to [10] is that urban space where the citizen suffers feelings of fear before the possibility of a crime. This research showed that a mobile application can improve the following key performance indicators (KPIs); KPI1: number of reports of dangerous places, KPI2: number of reports per crime, KPI3: response time in dealing with a complaint.

The article is organized in the following sections: 1. Introduction, 2. Review of the literature where the works related to the subject are shown; section 3. Methodology shows the development of the investigation; section 4. Results obtained; the section 5. Discussion of the results and finally in section 6. Conclusions.

2. LITERATURE REVIEW

Early research on dangerous places focused on a typological description of the place and the feeling of fear it generated [11]; defensible space, social control and the way in which the architectural design of places and streets influenced the occurrence of crime [12], [13]. Based on the emphasis on place at the neighborhood or residential scale, several studies, such as the one carried out in [14]. In Poland, have focused on the spatial distribution of fear in the population and the places where it develops. Studies, such as [12] have concluded that the physical environment can increase or decrease opportunities for crime. Research such as [15] have been able to relate crime patterns to the physical layout of the environment and the locations where crimes generally occur. With respect to the development of Information technology (IT) solutions, the research and development of [16] proposes a computational system based on mobile devices that allows the creation of crime indicators within a cartographic map. With this system, the end user will be able to identify, assimilate and avoid crime, as well as to collaborate with its reduction and eradication. The work is developed in the framework of the notorious increase in the perception of insecurity by the citizens of Mexico City. As a result of the study, map models with geo-referenced incidents are provided by means of a geographic information system as the main tool. It also makes use of geolocation and mobile positioning, with the purpose of contributing to crime monitoring, detecting mishaps early, and serving as a basis for decision making in security matters.

The research [17] aims to analyze how the adoption of technological innovations can affect the performance of activities related to practices and procedures carried out by the agencies of the criminal justice system. It adopts the exploratory qualitative methodology through the case study approach on the implementation of the technological tool PMSC Mobile by the Military Police of the state of Santa Catarina (PMSC). The results reveal that this tool contributes positively to the rationalization of the registration of police events, to the better allocation of financial and human resources and to the greater accuracy of criminal information records. Being able to identify the population and determine the exact location where a criminal act occurs is fundamental to fight crime, investigation [18] develops a novel framework that automatically detects and segments the crowd by integrating appearance features from multiple sources. It uses images with different crowd densities, camera viewpoints, and pedestrian appearances. It is determined that the proposed framework works well in accurately segmenting the crowd in complex scenes.

3. METHOD

The scrum methodology [19] was used for the development of the mobile application. It is a flexible software development management methodology, whose main objective is to maximize the return on investment for your business. It is based on the creation of the most valuable functions for the customer first and on the principles of continuous testing, adaptation, self-management and innovation.

3.1. Initiation

3.1.1. Stakeholders

Actors: District Municipality of San Juan Bautista-Huamanga-Ayacucho-Perú. The population was made up of people between 15 and 29 years of age (young people) who have no knowledge of the places with the most criminal acts in the city of Ayacucho-Huamanga in the district of San Juan Bautista, Perú. It is shown in detail in Table 1.

Table 1. Study population. source: INEI, Peru

Variable	Population	12 to 17 years old (adolescents)	15 to 29 years (young people)	60 and over (seniors)
Ayacucho	696.1152	87.085	200.064	55.228
Huamanga	281.270	35.545	90.713	17.397
San Juan Bautista	27.617	7.076	18.083	2.458

Application users: citizens of the district of San Juan Bautista-Huamanga-Ayacucho-Perú. The sample was calculated on the formula (1),

$$Sample\ size = \frac{\frac{Z^2\ x\ p(1-p)}{e^2}}{1+(\frac{Z^2\ x\ p(1-p)}{e^2 N})} \quad (1)$$

Under a margin of error of 10%, the sample (n) was composed of 96 people from the district of San Juan Bautista between the ages of 15 and 29. Developers: authors of this scientific article.

3.2. Planning

3.2.1. Hardware

Processor Intel Core i7. 8 GB of RAM, 1 TB harddisk. Operating system Windows 10 professional 64 bits.

3.2.2. Software

Visual Studio Code, it is a computer application program intended to make life easier for developers and programmers. Visual Studio Code is an identifier that refers to an integrated or interactive development environment [20]. Android, it is the most widely used operating system in mobile devices, generally with a touch screen. Thus, it is possible to find tablets, cell phones and watches equipped with Android [21], although the program is also used in cars, televisions and other devices. Programming language Kotlin, it is a static programming language that runs on top of the Java virtual machine and can also be compiled into JavaScript source code [22]. Google Maps, it is an advanced service offered by Google in which you can find exact locations of different cities, businesses, hotels, and people [23]. Firebase, it is a digital platform used to promote the efficient, fast and easy development of web or mobile applications [24], and is used as various functions of digital marketing technology to increase the user base and generate greater economic benefits [25].

3.3. Production

The architecture to be used by the mobile application is defined. Figure 1 shows the architecture used and its integration with the other devices. Continuous synchronization of data between the web server and the mobile application is displayed.

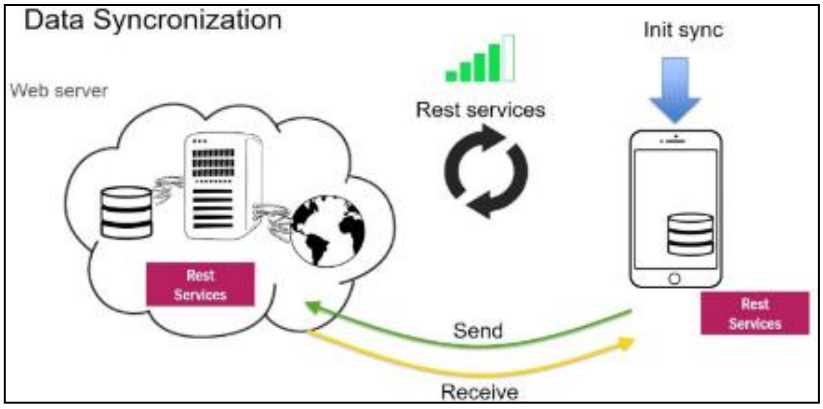


Figure 1. Application architecture

3.4. Application

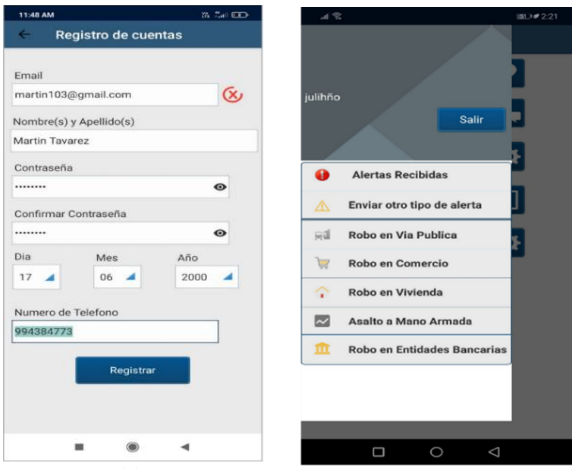
Figure 2 shows the first interfaces of the application. Figure 2(a) shows the registration form for a new user, then the user is validated by sending a confirmation code to the e-mail, or by text message to the cell phone; Figure 2(b) shows the main menu once the user is validated, with modules to send instant alerts to the police, about different types of theft.

Figure 3 shows the interfaces for making a crime report. All alerts sent to the crime center are done in real time, the application automatically records the location of the incident through GPS. The central analyzes the message and comes to the aid to perform the respective intervention, likewise, the user can

visualize the proximity of the police officer. Figure 3(a) shows an example of possible crime reports, "armed robbery" where the user can leave by default the date and time of the robbery, as well as send its location in real time, send a photo or video of the event, and send a specific message. In Figure 3(b) complete a questionnaire to provide more information to police personnel.

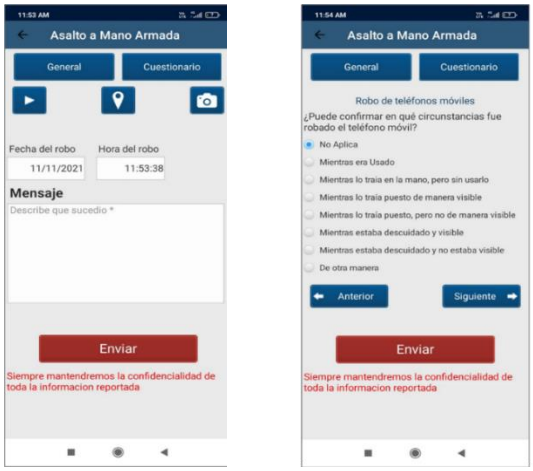
The identification of the most dangerous places is shown in Figure 4. Thanks to the reports generated by users and validated by police personnel, a map of the most dangerous places in the district is established, as shown in Figure 4(a), where the red dots and the emoji represent dangerous places. Figure 4(b) shows the contributions made by the user, i.e., the different types of alerts sent by a user.

The functions of the administrator are shown in Figure 5. The application administrator has multiple functions, such as deleting or blocking users who misuse the application. Figure 5(a) issuing alert responses as well as displaying the reports in a pie chart, which indicates the percentages by type of crimes reported Figure 5(b).



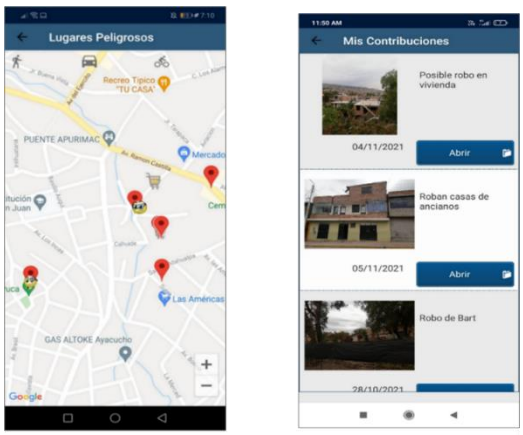
(a) (b)

Figure 2. Main menu of the mobile application in (a) the account registration and (b) the user's session



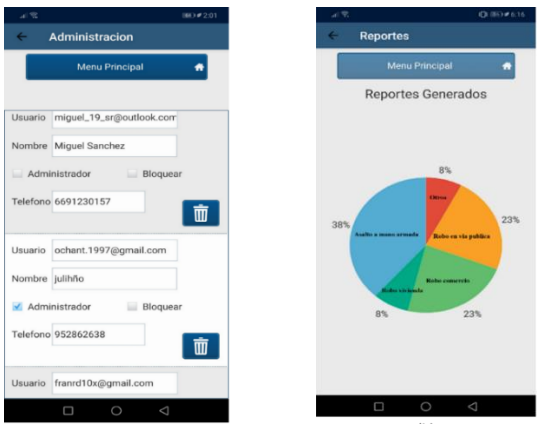
(a) (b)

Figure 3. Send an alert type in (a) log of the general description of the assault and (b) the questionnaire



(a) (b)

Figure 4. Identification of dangerous zones in (a) the location of dangerous locations in the district and (b) user contributions



(a) (c)

Figure 5. Administrator authority on (a) user data and permissions and (b) reports generated

4. RESULTS

The objective of this research was to determine how the implementation of the mobile application influences the improvement of citizen security. Three KPIs were considered according to the theoretical

basis. Where different averages were obtained for pre and post, the results of each indicator are detailed in Indicator 1 (KPI1), Indicator 2 (KPI2), and Indicator 3 (KPI3).

4.1. Indicator 1 (KPI1)

Number of dangerous zones reports. In order to select the hypothesis test, the data were subjected to a distribution test. Specifically, whether the data on the number of reports of dangerous places had a normal distribution.

As shown in Figure 6 the significance of the pre test is 0.000 and the significance of the post test is 0.000. When both values are less than 0.05, it is confirmed that the data have a non-normal distribution. A non-parametric test with related data, Wilcoxon test, will be used.

According to Table 2, the Wilcoxon non-parametric test shows a significance level of 0.00, less than 0.05, a cut-off value to know if the research hypothesis is acceptable or not. In this context, since the p-value is less than 0.05, the alternative hypothesis (H1) is accepted and the null hypothesis (H0) is rejected, affirming that the development of the mobile application to improve citizen security does influence crime prevention.

Figure 7 shows in bar graph the results obtained in the pre and post study, with respect to KPI1: Number of reports of dangerous places. According to the results shown, for the indicator number of reports of dangerous places (KPI1), in the pre-test a value in the mean of 3.75 was obtained and for the post-test it was 7.60. With these results it can be seen that there was an increase of 102.7%.

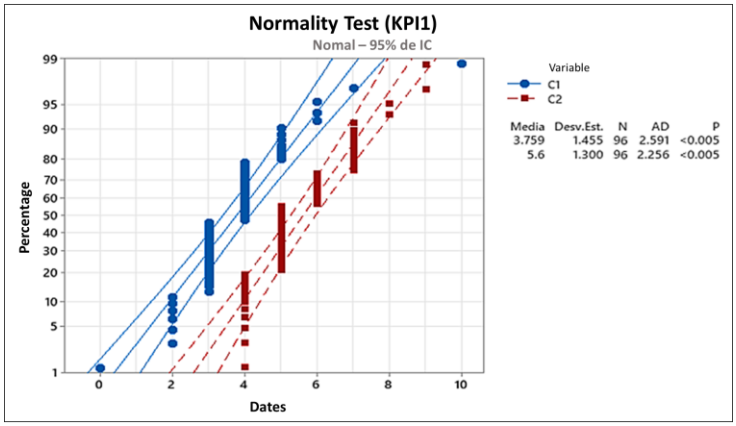


Figure 6. Normality test with Minitab KPI1

Table 2. Wilcoxon test KPI1

	Dangerous_Places_POST-Dangerous_Places_PRE
Z	-6,367[b]
Sig. asymptotic(bilateral)	,000

a. Wilcoxon signed-rank test

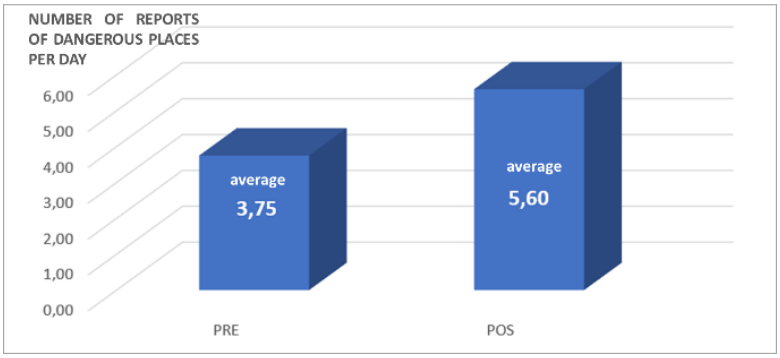


Figure 7. Histogram pre test and post test of the indicator KPI1

4.2. Indicator 2 (KPI2)

Number of reports by type of crime. To choose a hypothesis test the data is based on verifying its distribution, especially if the data on the number of reports of hazardous locations had a normal distribution.

It is observed in Figure 8 that the sig. of the pre test is 0.000 and the sig. of the post test is 0.000. When both values are less than 0.05, it is confirmed that the data have a non-normal distribution. A non-parametric test with related data, Wilcoxon test, will be used.

With what is observed in Table 3, using the nonparametric Wilcoxon test. There is a significance level of 0.01, less than 0.05, a cut-off value to know if the research hypothesis is acceptable or not. In this context, since the p-value is less than 0.05, H1 is accepted and H0 is rejected. It can be affirmed that the development of the mobile application to improve citizen security does have an influence on crime prevention.

Figure 9 shows in bar graph the results obtained in the pre and post study, with respect to KPI2: number of reports by type of crime. According to the results shown, for the indicator number of reports per type of crime (KPI2), in the pre-test the mean value was 3.71 and for the post-test it was 4.65. With these results it can be seen that there was an increase of 25.34%.

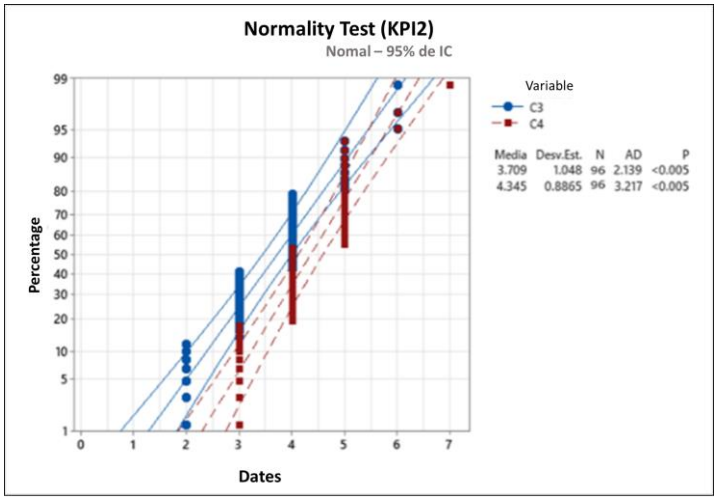


Figure 8. Normality test with Minitab KPI2

Table 3. Wilcoxon test KPI2

	Report by Type of Crime _POST - Report by Type of Crime _PRE
Z	-3,293[b]
Sig. asymptotic(bilateral)	,001

a. Wilcoxon signed-rank test

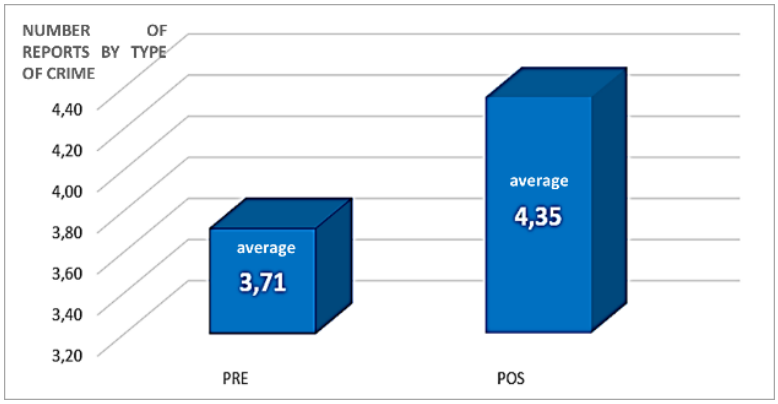


Figure 9. Histogram pre test and post test of the indicator KPI2

4.3. Indicator 3 (KPI3)

KPI3: Response time to attention. A survey was conducted to collect this information, as shown in Figure 10. According to the results shown, for the indicator response time to care, a bar chart was made to differentiate the questions according to the pre and the post. Showing an increase of 23.5%.

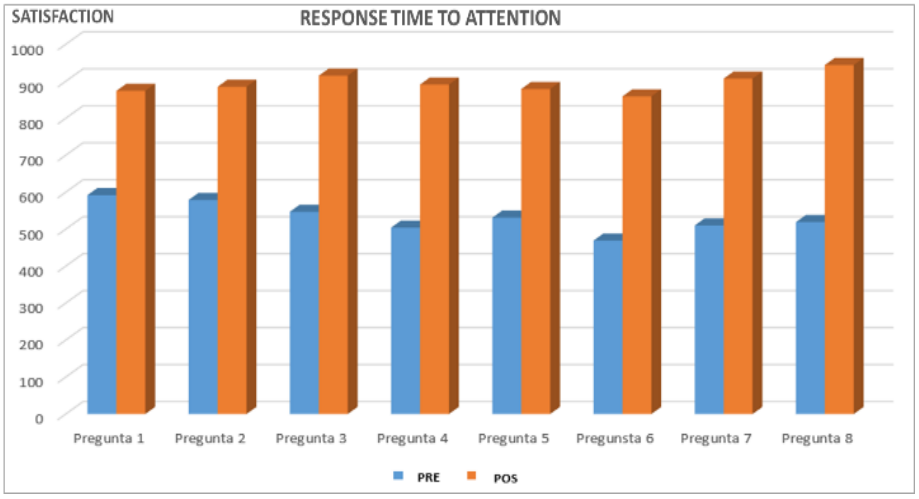


Figure 10. Histograma pre test and post test of the indicador KPI3

5. DISCUSSION

In From the results obtained in the present research work, it can be seen that there was a positive increase in crime prevention. Likewise, the hypothesis tests have a significance level of less than 0.05. Thus, determining through descriptive statistics, that there is a significant influence of the implementation of the mobile application to improve citizen security. There are different researches analyzing citizen security, which perceive how the most reliable technologies prevent citizen security throughout the territory. Therefore, users must be convinced that the technology will work in the best interest of every citizen [26]. The positive results are corroborated in research such as [27], where a mobile geolocation system is used for citizen security, which is used as one of the characteristics in this research. Thus, in the investigation [28], positive results have been obtained in the development of a system capable of detecting whether a tweet is related to security, which is used to present the perception of security in a city on a heat map, similar to the results obtained in the first indicator KPI1.

6. CONCLUSION

The current context was analyzed and a mobile application was developed to improve citizen security. It is concluded that the mobile application developed helps to combat crime, as evidenced by the positive results obtained with respect to the indicators "number of reports of dangerous places", "identification of the type of crime" and "response time in the attention". It is concluded that the implementation of the mobile application has a vision of continuing to grow with the new user needs. It is recommended to continue with research according to the scope of citizenship, relying on the use of Smartphone whose use trend is increasing due to times of pandemic.

REFERENCES

[1] United Nations, "Crime causes more deaths than armed conflicts," *Noticias ONU*, 2019. https://www.un.org/es/un75/new-era-conflict-and-violence (accessed Jan. 22, 2022).
[2] H. Heikkilä, W. Maalouf, and G. Campello, "The United Nations Office on Drugs and Crime's efforts to strengthen a culture of prevention in low- and middle-income countries," *Prev. Sci.*, vol. 22, no. 1, pp. 18–28, Jan. 2021, doi: 10.1007/s11121-020-01088-5.
[3] INEI, "18.6% of the population aged 15 years and older were victims of a criminal act in the six-month period November 2020 - April 2021," *Diario*, 2021. https://m.inei.gob.pe/prensa/noticias/el-186-de-la-poblacion-de-15-y-mas-anos-de-edad-fue-victima-de-algun-hecho-delictivo-en-el-semestre-noviembre-2020-abril-2021-12959/ (accessed Dec. 18, 2021).
[4] A. Rahman, G. Wu, and A. M. Liton, "Mobile edge computing for internet of things (IoT): security and privacy issues," *Indones. J. Electr. Eng. Comput. Sci.*, vol. 18, no. 3, p. 1486, Jun. 2020, doi: 10.11591/ijeecs.v18.i3.pp1486-1493.

[5] J. Amachi-Choqque and M. Cabanillas-Carbonell, "IoT system for vital signs monitoring in suspicious cases of Covid-19," *Int. J. Adv. Comput. Sci. Appl.*, vol. 12, no. 2, pp. 174–180, 2021, doi: 10.14569/IJACSA.2021.0120223.
[6] A. Ramos-Romero, B. Garcia-Yataco, and L. Andrade-Arenas, "Mobile Application Design with IoT for Environmental Pollution Awareness," *Int. J. Adv. Comput. Sci. Appl.*, vol. 12, no. 1, pp. 566–572, 2021, doi: 10.14569/IJACSA.2021.0120165.
[7] E. Correo, "This is how the coronavirus has changed our use of the mobile," 2020. https://www.elcorreo.com/tecnologia/moviles/cambiado-coronavirus-movil-20200323115618-nt.html (accessed Dec. 11, 2021).
[8] E. Peruano, "Law No. 27933, of the National Citizen Security System," 2014. https://www.gob.pe/institucion/congreso-de-la-republica/normas-legales/331205-27933 (accessed Dec. 15, 2021).
[9] M. R. Khatun, S. I. Ayon, M. R. Hossain, and M. J. Alam, "Data mining technique to analyse and predict crime using crime categories and arrest records," *Indones. J. Electr. Eng. Comput. Sci.*, vol. 22, no. 2, p. 1052, May 2021, doi: 10.11591/ijeecs.v22.i2.pp1052-1060.
[10] M. Haner, M. M. Sloan, J. T. Pickett, and F. T. Cullen, "Safe haven or dangerous place? stereotype amplification and americans' perceived risk of terrorism, violent street crime, and mass shootings," *Br. J. Criminol.*, vol. 60, no. 6, pp. 1606–1626, Jul. 2020, doi: 10.1093/bjc/azaa045.
[11] W. M. Rohe and R. J. Burby, "Fear of crime in public housing," *Environ. Behav.*, vol. 20, no. 6, pp. 700–720, Nov. 1988, doi: 10.1177/0013916588206003.
[12] T. D. Miethe and O. Venger, "Public perceptions of dangerous places: sources of variability in evaluating criminogenic environments," *Secur. J.*, Apr. 2021, doi: 10.1057/s41284-021-00297-z.
[13] S. Gerrard, "When women take the lead: changing conditions for women's activities, roles and knowledge in North Norwegian fishing communities," *Soc. Sci. Inf.*, vol. 34, no. 4, pp. 593–631, Dec. 1995, doi: 10.1177/053901895034004004.
[14] E. Bogacka and A. Siniecka, "A microscale study on perception of dangerous places. The case of Gniezno, Poland," *Acta Sci. Pol. Adm. Locorum*, vol. 19, no. 3, pp. 137–148, Sep. 2020, doi: 10.31648/aspal.5299.
[15] P. K. de Oliveira and B. Hillesheim, "Dancing in order to move: the emergence of dangerous places," *Psicol. Soc.*, vol. 31, pp. 1–15, 2019, doi: 10.1590/1807-0310/2019v312045764.
[16] A. Espinoza-Ramírez, M. Nakano, G. Sánchez-Pérez, and A. Arista-Jalife, "Geographic information systems and their analysis applied in crime areas in Mexico City," *Inf. tecnológica*, vol. 29, no. 5, pp. 235–244, 2018, doi: 10.4067/s0718-07642018000500235.
[17] C. C. Ferreira, B. R. Corrales, L. C. Cote, and M. T. Teixeira, "Technology at hand for public security - a case study of PMSC mobile," *Rev. Direito GV*, vol. 16, no. 1, 2020, doi: 10.1590/2317-6172201947.
[18] S. Basalamah and S. Daud, "Pedestrian crowd detection and segmentation using multi-source feature descriptors," *Int. J. Adv. Comput. Sci. Appl.*, vol. 11, no. 1, pp. 707–713, 2020, doi: 10.14569/IJACSA.2020.0110187.
[19] K. Schwaber and J. Sutherland, *The Scrum Guide. The Definitive Guide to Scrum: The Rules of the Game*. 2020.
[20] Microsoft, "Visual Studio: IDE and Code Editor for Software Developers and Teams," 2022. https://visualstudio.microsoft.com/es/ (accessed Jan. 20, 2022).
[21] K. A. Adeniji, N. T. Surajudeen-Bakinde, O. O. Omitola, and A. Ajibade, "Validation of android-based mobile application for retrieving network signal level," *Indones. J. Electr. Eng. Comput. Sci.*, vol. 21, no. 1, p. 296, Jan. 2021, doi: 10.11591/ijeecs.v21.i1.pp296-304.
[22] K. Wasilewski and W. Zabierowski, "A comparison of Java, Flutter and Kotlin/Native technologies for sensor data-driven applications," *Sensors*, vol. 21, no. 10, p. 3324, May 2021, doi: 10.3390/s21103324.
[23] T. D. Indriasari, K. Anindito, E. Julianto, and B. L. P. Pangaribuan, "A mobile and web application for mapping disaster volunteers' position in Indonesia," *Int. J. Interact. Mob. Technol.*, vol. 11, no. 3, p. 98, Apr. 2017, doi: 10.3991/ijim.v11i3.6477.
[24] R. Patnaik, R. Pradhan, S. Rath, C. Mishra, and L. Mohanty, "Study on Google Firebase for real-time web messaging," in *Intelligent and Cloud Computing*, vol. 194, Springer Science and Business Media Deutschland GmbH, 2021, pp. 461–469.
[25] P. V. Crisgar, P. R. Wijaya, M. D. F. Pakpahan, E. Y. Syamsuddin, and M. O. Hasanuddin, "GPS-based vehicle tracking and theft detection systems using Google Cloud IoT core & Firebase," in *2021 International Symposium on Electronics and Smart Devices (ISESD)*, Jun. 2021, pp. 1–6, doi: 10.1109/ISESD53023.2021.9501928.
[26] P. Dayang, "Contribution of mobile messaging applications to improve citizen security," in *2016 IST-Africa Week Conference*, May 2016, pp. 1–8, doi: 10.1109/ISTAFRICA.2016.7530688.
[27] C. Guevara, D. Bonilla, J. Pozo, R. Perez, H. Arias, and L. Martinez, "Mobile geographic information system for citizen security," in *2019 14th Iberian Conference on Information Systems and Technologies (CISTI)*, Jun. 2019, no. June, pp. 1–6, doi: 10.23919/CISTI.2019.8760713.
[28] J. E. Camargo, C. A. Torres, O. H. Martinez, and F. A. Gomez, "A big data analytics system to analyze citizens' perception of security," in *2016 IEEE International Smart Cities Conference (ISC2)*, Sep. 2016, pp. 1–5, doi: 10.1109/ISC2.2016.7580846.

BIOGRAPHIES OF AUTHORS

Yulihño Ochante-Huamaccto Graduated in Systems Engineering from the Autonomous University of Peru. His early foray into technology and his passion for continuous learning gave him extensive experience in relational databases; also for his work in government entities such as the Municipality of San Juan Bautista - Huamanga - Ayacucho - Peru, and higher education entities such as the Autonomous University of Peru. He acquired experience in the field of programming in different languages thanks to different projects carried out in private consultancies dedicated to information technologies. Where it is researching and developing technologies that combine Artificial Intelligence. He can be contacted at yochante@autonoma.edu.pe.

Francis Robles-Delgado Graduated in Systems Engineering from Universidad Autónoma del Perú. His early incursion in technology and his passion for continuous learning gave him a wide experience in relational databases applied in private and higher education entities such as the Universidad Autónoma del Perú. He gained experience in the field of programming in different languages thanks to different projects carried out in private companies and educational centers. He can be contacted at froblesd@autonoma.edu.pe.

Fernando Sierra-Liñan Mg. Fernando Sierra-Liñan has a Bachelor's degree in Education, specializing in Science and Technology at USIL, a Master's degree in Edumatics and University Teaching at UTP, a Bachelor's degree in Systems Engineering and Computer Science at UTP, with a technical specialty in Computer Science and Computer Science. He is currently working as a researcher and thesis advisor in the faculty of Computer Engineering and Systems at the Universidad Privada del Norte, Lima - Peru. He has 20 years of teaching experience. His areas of interest are programming, database and data analysis. E-mail: fernando.sierra@upn.edu.pe, pfsierra.D02052@gmail.com.

Michael Cabanillas-Carbonell Engineer and Master in Systems Engineering from the National University of Callao - Peru, PhD candidate in Systems Engineering and Telecommunications at the Polytechnic University of Madrid. President of the chapter of the Education Society IEEE-Peru. Conference Chair of the Engineering International Research Conference IEEE Peru EIRCON. Research Professor at Norbert Wiener University, Professor at Universidad Privada del Norte, Universidad Autónoma del Perú. Advisor and Jury of Engineering Thesis in different universities in Peru. International lecturer in Spain, United Kingdom, South Africa, Romania, Argentina, Chile, China. Specialization in Software Development, Artificial Intelligence, Machine Learning, Business Intelligence, Augmented Reality. Reviewer IEEE Peru and author of more than 25 scientific articles indexed in IEEE Xplore and Scopus. He can be contacted at mcabanillas@ieee.org.